5. Total Maximum Daily Loads

A TMDL prescribes an upper limit on discharge of a pollutant from all sources so as to assure water quality standards are met. It further allocates this *load capacity* (LC) among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a *wasteload allocation* (WLA); and nonpoint sources, which receive a *load allocation* (LA). *Natural background* (NB), when present, is considered part of the load allocation, but is often broken out on its own because it represents a part of the load not subject to control. Because of uncertainties regarding quantification of loads and the relation of specific loads to attainment of water quality standards, the rules regarding TMDLs (Water quality planning and management, 40 CFR 130) require a *margin of safety* (MOS) be a part of the TMDL.

Practically, the MOS is a reduction in the load capacity that is available for allocation to pollutant sources. The natural background load is also effectively a reduction in the load capacity available for allocation to human made pollutant sources. This can be summarized symbolically as the equation: LC = MOS + NB + LA + WLA = TMDL. The equation is written in this order because it represents the logical order in which a loading analysis is conducted. First the LC is determined. Then the LC is broken down into its components: the necessary MOS is determined and subtracted; then NB, if relevant, is quantified and subtracted; and then the remainder is allocated among pollutant sources. When the breakdown and allocation is completed we have a TMDL, which must equal the LC.

Another step in a loading analysis is the quantification of current pollutant loads by source. This allows the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary in order for pollutant trading to occur. Also a required part of the loading analysis is that the LC be based on critical conditions – the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both LC and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can be more complicated than it may appear on the surface.

A load is fundamentally a quantity of a pollutant discharged over some period of time, and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for “other appropriate measures” to be used when necessary. These “other measures” must still be quantifiable, and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads, and allow “gross allotment” as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

5.1 TMDL Components

In the subbasin assessment it was identified which water bodies were impaired by a pollutant and will have a TMDL completed, the following describes the design conditions, target selection, and monitoring points for instream water quality targets, along with load capacity, estimates of existing pollutant loads, load allocation, and implementation strategies.

The goal of the TMDL and implementation process is to restore “full support of designated beneficial uses” (Idaho Code 39.3611, 3615) by determining load allocations for the pollutants impacting a water body. Through the subbasin assessment process, it has been identified what pollutants or pollution are impacting the impaired water body. In the case where pollutants are impacting a water body, a TMDL will be completed to determine necessary load allocations for point source and nonpoint source activities occurring in the water body. In the case of pollution (lack of flow or habitat alteration) impacting a water body, a TMDL will not be completed for the pollution.

Design conditions, target selections, and monitoring points become critical issues in developing a TMDL and tracking improvement in a water body and will be discussed for each water body and pollutant impaired.

The load capacity is a value that estimates the quantity of pollutant the water body can assimilate and still meet water quality standards. The load capacity is determined by various calculations depending on the pollutant. The load capacity must be a level to meet “...water quality standards with season variations and a margin of safety which takes into account any lack of knowledge...” (Clean Water Act § 303(d)(C)). In developing a load capacity for the water body, the likely sources of uncertainty include lack of knowledge of assimilative capacity, uncertain relation of selected targets to beneficial uses, and variability in target measurement.

Existing loads are estimates of the quantity of pollutant occurring in a water body. Data that is used to determine existing loads is typically very limited and not necessarily very representative of the average condition. However due to court appointed timelines, it is the best available data. Regulations allow that loadings “...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading,” (Water quality planning and management, 40 CFR § 130.2(I)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of sources (land use) and area (such as a subwatershed), but may be aggregated by type of source or land area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads.

Load allocation represents the portion of the load capacity of the stream that is allocated to existing nonpoint source activities, nonpoint source future growth, and background loads occurring within the watershed. Wasteload allocations are the allocations given to the point sources within the watershed, these allocations are calculated based on discharge monitoring report data and design flows. When data from the point source is not available, estimates are calculated. The following formula represents allocation division in a TMDL: LC=LA+WLA+BG+MOS+FG.

The margin of safety (MOS) represents 10% of the load capacity of the water body. This value provides an allocation that is not given to a pollutant source to provide for uncertainty in load capacity.

The future growth (FG) component takes into account a portion of the loading capacity that is reserved for future development within the watershed. At the request of the Wood River Watershed Advisory Group an allocation of 5% has been set aside for future growth.

Seasonal variation occurs within a pollutant and within a water body. The hydrologic regime of the water body as well as land-use management practices influences the seasonal variation in the water body. Seasonal variation within each 303(d) listed water body was discussed in the subbasin assessment portion of this document.

The TMDLs that were completed in this subbasin were on the following water bodies: Soldier Creek, Willow Creek, Beaver Creek, Little Beaver Creek, Camp Creek, Elk Creek, Corral Creek, Cow Creek, Wild Horse Creek, McKinney Creek, Dairy Creek, and Camas Creek. The TMDLs completed on Dairy Creek and McKinney Creek will aid in improving the water quality of Mormon Reservoir.

Soldier Creek

Through the subbasin assessment process, it has been identified that the water quality of Soldier Creek is being impacted by pollutants. The pollutants of concern in the water body have been found to be sediment and temperature. For a summary of load reductions for this water body see Table 70, for load allocations see Table 71, and for segmental breakdown of stream bank erosion values see Table 72.

Lack of flow is the largest impact to beneficial uses of Soldier Creek. Soldier Creek is impaired due to a lack of flow; however, EPA does not believe that flow (or lack of flow) is a pollutant as defined by CWA Section 502(6). Since TMDLs are not required to be established for water bodies impaired by pollution, a TMDL has not been established for Soldier Creek for flow.

Design Conditions

Sediment impacts a water body during higher flow events, when the carrying capacity of the stream is greater and erosion is more likely to occur. Typically the higher flow events occur during spring runoff or periodically during storm situations; as a result the critical period for sediment on Soldier Creek has been identified as occurring from March to May. During this period the critical flow for the water body based on the predicted hydrograph is 67.4 cfs. As sediment has been found to be occurring as a result of stream bank erosion the critical flow period is less important in the development of stream bank stability TMDLs.

Solar radiation impacts the temperature of a water body during the late spring and summer months, when canopy cover is the major component that maintains cooler water temperatures. As a result the critical period for temperature on Soldier Creek has been identified as occurring from April to September. During this time, the critical flow for the water body, based on the predicted hydrograph, is 36.0 cfs. As a temperature TMDL targets canopy cover of a creek, the critical flow is less important in the development of a temperature TMDL.

Target Selection

Target selections are discussed in more complete detail in the subbasin assessment (SBA) portion of this document under the section *Analysis Process* (page 45). The water quality standards for the various pollutants can also be viewed in Appendix 3.

Sediment is impacting water quality of Soldier Creek in the form of bedload sediment. Suspended sediment measured during drought years is not impacting water quality of the stream, however bedload sediment measured in the form of percent fines indicates that sediment is impacting water quality. A value greater than 35% for percent fines was used to indicate that sediment was impacting the water body. If this was the case then stream bank erosion inventories were completed to determine if stream bank erosion was a contributor of sediment impact. The target for stream bank erosion is 80% bank stability.

Temperature is impacting the water quality of Soldier Creek and canopy cover is the method used to determine the amount of solar radiation the creek is receiving. Vegetation type and bankfull width were used to characterize the creek, then the Alvord Lake TMDL was used to aid in target selection based on these values (Table 22). The targets for the sections of the water bodies are as follows: upper (55%) and lower (30%). If the aerial photo estimates are less than the appropriate canopy cover target, canopy cover needs to be improved within the segment. Aerial photo estimations likely underestimate segments that have higher cover and overestimate segments that have lower cover, however in terms of the creek as a whole, these balance themselves out. This should be taken into account however during the implementation phase; the more critical areas are likely to be the areas with the least amount of canopy cover.

Monitoring Points

Because a stream bank erosion TMDL is site specific and cannot be measured by a pour point value, as some of the other constituents can, there is no monitoring point to be measured for identification. One possible way of tracking changes within the system would be various Wohlman pebble counts in locations that have been used in the past. For the stream bank erosion TMDL, the water body has been divided into three segments. These segments are as follows: upper, middle, and lower.

The monitoring point for temperature collection for TMDL development occurred about 2.5 miles upstream of the mouth and just downstream of the North and South Forks. Both sites can be used to identify further trends within the system, however the site upstream of the mouth should be used to determine if water quality standards on Soldier Creek are being met.

Load Capacity

The load capacities of the two TMDLs to be completed on Soldier Creek have been determined in different ways.

- The load capacity (99.2 tons per year [t/yr]) for stream bank erosion TMDLs was set using calculations that took into account erosion rates, bank height, and quantity of stream bank stability.
- The load capacity (702,970.0 kilowatt hours/day [kWh/day]) for the temperature TMDL was determined by converting canopy cover targets to solar radiation.

These values represent the estimated quantity of pollutant the water bodies are believed to be able to assimilate and still maintain beneficial uses full support status and meet water quality standards.

Estimates of Existing Pollutant Loads

The estimated existing loads for the two TMDLs to be completed on Soldier Creek are elevated above the load capacity of the water body:

- The existing load (772.2 t/yr) for stream bank erosion TMDLs was set using calculations that took into account erosion rates, bank height, and quantity of stream bank stability.
- The existing load (866,896.9 kWh/day) for temperature TMDLs was calculated as the sum of the amount of solar radiation for the segments of the creek.

These values represent the estimated existing load of pollutant occurring in the water body.

Load Allocation

The wasteload allocation for Soldier Creek incorporates construction storm water wasteload allocations, as well as wasteload allocations for the City of Fairfield. The wasteload allocation for construction storm water was determined by allocating 2% of the load capacity to construction storm water. *The wasteload allocation for construction storm water is 1.7 t/yr. The wasteload allocation for the City of Fairfield is 7.5 t/yr. The intent of this sediment TMDL is not to make the City of Fairfield's discharge permit any more restrictive than it already is. The combined sediment wasteload allocation for Soldier Creek is 9.2 t/yr.*

Construction storm water is not likely to impact the canopy cover; therefore a waste load allocation is not made for construction storm water in this watershed. However, there is a point source facility that does discharge to the creek.

This temperature TMDL is based on meeting potential natural riparian vegetation conditions in the watershed. Shade targets were developed with the idea that once shade levels are met, streams will achieve temperatures consistent with those achievable under natural conditions. Once natural conditions are known, point source discharges must not cumulatively increase receiving water temperature more than 0.3ºC above the natural stream temperature as stated in Idaho water quality standards (IDAPA 58.01.02.200.09 and IDAPA 58.01.02.401.03.v).

Prior to determining the natural temperature condition in a stream, point source discharges should not contribute water that will elevate the temperature of the receiving water above a 0.3 degree increase above average salmonid spawning temperatures (9 degrees Celsius), during the period of elevated temperatures (March 15 through July 15). The temperature of the effluent the point source will be capable of discharging will vary according to effluent flows and creek flows (Table 73). Additionally, point source dischargers should collect monitoring data on the temperature of their discharge and their receiving stream immediately above and below the discharge point. These data can be used in the future to ascertain applicability of the above referenced natural background provisions.

Background, MOS, and FG are values attributed to the watershed that are beyond human control, provide some flexibility within the watershed, and allow for future growth within the watershed. Calculations for each of these components were determined in various ways:

- The BG loads are not determined for a stream bank erosion TMDL because it is implied that background loads occur within the target.
- The BG loads, MOS, and FG are not determined for a temperature TMDL because the canopy cover targets are set for natural potential vegetation.
- The MOS for the sediment TMDL of Soldier Creek is 10% of the load capacity (9.9 t/yr).
- The FG for the sediment TMDL of Soldier Creek is 5% of the load capacity (5.0 t/yr).

The final load allocations for nonpoint source activity are determined by reducing the load capacity of the water body by the wasteload allocations, background, MOS, and FG values. Therefore, the load allocation for sediment is 75.1 t/yr and for temperature is 702,970.0 kWh/day.

Table 70. Soldier Creek load reductions.

Pollutant	Critical flow (cfs)	Target	Load capacity	Existing Load	Percent reduction
Sediment	67.4	80	99.2	772.2	87.2
temperature	36.0	55-30	702,970.0	866,896.9	18.9

[a]Sediment- target measured in percent bank stability, load capacity and existing load measured in t/yrr.
[b]Temperature – target measured in percent canopy cover, load capacity and existing load measured in kWh/day.

Table 71. Soldier Creek load allocations.

Pollutant	MOS	BG	FG	Available Load	Wasteload allocation	Load Allocation
Sediment (t/yr)	9.9	implicit	5.0	84.3	9.2	75.1
Temperature (kWh/day)	n.a.	n.a.	n.a.	702,970.0	0.0	702,970.0

[a]Implicit- Background (BG) is implied within the target.
[b]Margin of safety (MOS) and Future growth (FG), n.a.-not applicable.

Table 72. Soldier Creek stream bank erosion values.

Reach	Existing Erosion rate	Proposed Erosion rate	Existing Total Erosion	Proposed Total Erosion	Erosion Rate Percent Reduction	Percent of Existing Total Load
Upper	2.4	3.5	12.6	17.9	0	1.63
Middle	11.2	5.2	70.1	32.5	54	9
Lower	157.2	11.1	689.5	48.8	93	89
Total			772.2	99.2		

[a]See Appendix 4 for site descriptions
[b]Erosion rates measured in tons/mile/year. Total erosion measured in tons/year.

Table 73. City of Fairfield allowable effluent temperatures.

Soldier Creek flow (cfs)	Fairfield Effluent Discharge (cfs)				
	0.05	0.1	0.15	0.2	0.225
5	16.8	13.1	11.8	11.2	11.0
10	24.3	16.8	14.3	13.1	12.6
20	39.3	24.3	19.3	16.8	16.0
30	54.3	31.8	24.3	20.6	19.3
40	69.3	39.3	29.3	24.3	22.6
50	84.3	46.8	34.3	28.1	26.0
60	99.3	54.3	39.3	31.8	29.3
70	114.3	61.8	44.3	35.6	32.6

[a]The calculation used to determine the effluent temperatures (degrees Celsius) is {[(effluent flow + (0.25 x creek flow)) x (9 +0.3)] – [(0.25 x creek flow) x 9]} / effluent flow.

Reasonable Assurance

There is reasonable assurance that implementation, as the next step of the water body management process, will occur. First this document includes implementation strategies as described in subsequent pages; Idaho’s water quality standards identify designated agencies that are responsible for evaluating and modifying best management practices to protect impaired water bodies. The state has committed itself to having implementation plans developed within 18 months of approval of the TMDL document. DEQ, the *Watershed Advisory Group* (WAG), and the designated agencies will develop implementation plans, and

DEQ will incorporate them into the state's water quality management plan. Also, in measuring the effectiveness of an implementation activity, DEQ will reassess the support status of the water body to determine if the water body has reached full support status. If full support status has not been obtained then further implementation will be necessary and further reassessment completed until full support status is completed. If full support status is completed then the requirements of the TMDL will be considered completed.

Willow Creek

Through the subbasin assessment process, it has been identified that the water quality of Willow Creek is being impacted by a pollutant. The pollutant of concern in the water body has been found to be temperature. For a summary of load reductions for this water body see Table 74 and for load allocations see Table 75.

Design Conditions

Solar radiation impacts the temperature of a water body during the late spring and summer months, when canopy cover is the major component that maintains cooler water temperatures. As a result, the critical period for temperature on Willow Creek has been identified as occurring from April to September. During this time, the critical flow for the water body, based on the predicted hydrograph, is 46.1 cfs. As a temperature TMDL targets canopy cover of a creek, the critical flow is less important in the development of a temperature TMDL.

Target Selection

Target selections are discussed in more complete detail in the subbasin assessment (SBA) portion of this document under the section *Analysis Process* (page 45). The water quality standards for the various pollutants can also be viewed in Appendix 3.

Temperature is impacting the water quality of Willow Creek, and canopy cover is the method used to determine the amount of solar radiation the creek is receiving. Vegetation type and bankfull width were used to characterize the creek, then the Alvord Lake TMDL was used to aid in target selection based on these values (Table 28; page 74). The targets for the sections of the water bodies are as follows: upper (55%), middle (35%) and lower (50%). If the aerial photo estimates are less than the appropriate canopy cover target, canopy cover needs to be improved within the segment. Aerial photo estimations likely underestimate segments that have higher cover and overestimate segments that have lower cover; however, in terms of the creek as a whole, these balance themselves out. This should be taken into account ,however, during the implementation phase; the more critical areas are likely to be the areas with the least amount of canopy cover.

Monitoring Points

The monitoring point for temperature collection for TMDL development occurred near the mouth, about 6 miles upstream of the mouth, about 12 miles upstream of the mouth, and about 0.5 miles upstream of the West Fork. All sites can be used to identify further trends within the system; however, the lower site near the mouth should be used to determine if water quality standards on Willow Creek are being met.

Load Capacity

The load capacity estimates the quantity of pollutant the water body is believed to be able to assimilate and still maintain beneficial uses full support status and meet water quality standards. The load capacity (520,835.7 kWh/day) for the temperature TMDL was determined by converting canopy cover targets to solar radiation.

Estimates of Existing Pollutant Loads

The estimated existing load for the temperature TMDL to be completed on Willow Creek is elevated above the load capacity of the water body. The existing load (535,072.5 kWh/day) for temperature TMDLs was calculated as the sum of the amount of solar radiation for the segments of the creek. This value represents the estimated existing load of pollutant occurring in the water body.

Load Allocation

The wasteload allocation for Willow Creek is limited to construction storm water wasteload allocations. Wasteload allocations are not made for construction storm water for a temperature TMDL based on canopy cover.

Background, MOS, and FG are values attributed to the watershed that are beyond human control, provide some flexibility (due to uncertainty) within the watershed, and allow for future growth within the watershed. Background loads, MOS, and FG are not determined for a temperature TMDL because the canopy cover targets are set for natural potential vegetation.

The final load allocation for nonpoint source activity is determined by reducing the load capacity of the water body by the wasteload allocations, background, MOS, and FG values. Therefore, the load allocation for temperature in Willow Creek is 520,835.7 kWh/day.

Table 74. Willow Creek load reductions.

Pollutant	Critical flow (cfs)	Target	Load capacity	Existing Load	Percent reduction
Temperature	46.1	55-35-50	520,835.7	535,072.5	2.7

[a]Temperature – target measured in percent canopy cover, load capacity and existing load measured in kWh/day.

Table 75. Willow Creek load allocations.

Pollutant	MOS	BG	FG	Available Load	Wasteload allocation	Load Allocation
Temperature (kWh/day)	n.a.	n.a.	n.a.	520,835.7	0.0	520,835.7

[a]Background (BG), Margin of safety (MOS) and Future growth (FG), n.a.-not applicable.

Beaver Creek

Through the subbasin assessment process, it has been identified that the water quality of Beaver Creek is being impacted by a pollutant. The pollutant of concern in the water body has been found to be temperature. For a summary of load reductions for this water body see Table 76 and for load allocations see Table 77.

Design Conditions

Solar radiation impacts the temperature of a water body during the late spring and summer months, when canopy cover is the major component that maintains cooler water temperatures. As a result the critical period for temperature on Beaver Creek has been identified as occurring from April to September. During this time, the critical flow for the water body, based on the predicted hydrograph, is 8.1 cfs. As a temperature TMDL targets canopy cover of a creek, the critical flow is less important in the development of a temperature TMDL.

Target Selection

Target selections are discussed in more complete detail in the subbasin assessment (SBA) portion of this document under the section *Analysis Process* (page 45). The water quality standards for the various pollutants can also be viewed in Appendix 3.

Temperature is impacting the water quality of Beaver Creek and canopy cover is the method used to determine the amount of solar radiation the creek is receiving. Vegetation type and bankfull width were used to characterize the creek, then the Alvord Lake TMDL was used to aid in target selection based on these values (Table 34, page 83). The targets for the sections of the water bodies are as follows: upper (85%) and lower (60%). If the aerial photo estimates are less than the appropriate canopy cover target, canopy cover needs to be improved within the segment. Aerial photo estimations likely underestimate segments that have higher cover and overestimate segments that have lower cover; however, in terms of the creek as a whole, these balance themselves out. This should be taken into account however during the implementation phase; the more critical areas are likely to be the areas with the least amount of canopy cover.

Monitoring Points

The monitoring point for temperature collection for TMDL development occurred near the mouth and about 2.5 miles upstream of the mouth. Both sites can be used to identify further trends within the system; however, the lower site near the mouth should be used to determine if water quality standards on Beaver Creek are being met.

Load Capacity

The load capacity estimates the quantity of pollutant the water body is believed to be able to assimilate and still maintain beneficial use support status and meet water quality standards. The load capacity (33,948.0 kWh/day) for the temperature TMDL was determined by converting canopy cover targets to solar radiation.

Estimates of Existing Pollutant Loads

The estimated existing load for the temperature TMDL to be completed on Beaver Creek is elevated above the load capacity of the water body. The existing load (74,828.0 kWh/day) for temperature TMDLs was calculated as the sum of the amount of solar radiation for the segments of the creek. These values represent the estimated existing load of pollutant occurring in the water body.

Load Allocation

The wasteload allocation for Beaver Creek is limited to construction storm water wasteload allocations. Wasteload allocations are not made for construction storm water for a temperature TMDL based on canopy cover.

Background, MOS, and FG are values attributed to the watershed that are beyond human control, provide some flexibility (due to uncertainty) within the watershed, and allow for future growth within the watershed. Background loads, MOS, and FG are not determined for a temperature TMDL because the canopy cover targets are set for natural potential vegetation.

The final load allocation for nonpoint source activity is determined by reducing the load capacity of the water body by the wasteload allocations, background, MOS, and FG values. Therefore, the load allocation for temperature in Beaver Creek is 33,948.0 kWh/day.

Table 76. Beaver Creek load reductions.

Pollutant	Critical flow (cfs)	Target	Load capacity	Existing Load	Percent reduction
temperature	8.1	85-60	33,948.0	74,828.0	54.6

[a]Temperature – target measured in percent canopy cover, load capacity and existing load measured in kWh/day.

Table 77. Beaver Creek load allocations.

Pollutant	MOS	BG	FG	Available Load	Wasteload allocation	Load Allocation
Temperature (kWh/day)	n.a.	n.a.	n.a.	33,948.0	0.0	33,948.0

[a]Background (BG), Margin of safety (MOS) and Future growth (FG), n.a.-not applicable.

Little Beaver Creek

Through the subbasin assessment process, it has been identified that the water quality of Little Beaver is being impacted by a pollutant. The pollutant of concern in the water body has been found to be temperature. For a summary of load reductions for this water body see Table 78 and for load allocations see Table 79.

Design Conditions

Solar radiation impacts the temperature of a water body during the late spring and summer months, when canopy cover is the major component that maintains cooler water temperatures. As a result the critical period for temperature on Little Beaver Creek has been identified as occurring from April to September. During this time, the critical flow for the water body, based on the predicted hydrograph, is 5.8 cfs. As a temperature TMDL targets canopy cover of a creek, the critical flow is less important in the development of a temperature TMDL.

Target Selection

Target selections are discussed in more complete detail in the subbasin assessment (SBA) portion of this document under the section *Analysis Process* (page 45). The water quality standards for the various pollutants can also be viewed in Appendix 3.

Temperature is impacting the water quality of Little Beaver Creek and canopy cover is the method used to determine the amount of solar radiation the creek is receiving. Vegetation type and bankfull width were used to characterize the creek, then the Alvord Lake TMDL was used to aid in target selection based on these values (Table 40, page 91). The targets for the sections of the water bodies are as follows: upper (85%) and lower (75%). If the aerial photo estimates are less than the appropriate canopy cover target, canopy cover needs to be improved within the segment. Aerial photo estimations likely underestimate segments that have higher cover and overestimate segments that have lower cover; however, in terms of the creek as a whole, these balance themselves out. This should be taken into account however during the implementation phase; the more critical areas are likely to be the areas with the least amount of canopy cover.

Monitoring Points

The monitoring point for temperature collection for TMDL development occurred near the mouth and about 2.5 miles upstream of the mouth. Both sites can be used to identify further trends within the system; however, the lower site near the mouth should be used to determine if water quality standards on Little Beaver Creek are being met.

Load Capacity

The load capacity estimates the quantity of pollutant the water body is believed to be able to assimilate and still maintain beneficial use full support status and meet water quality standards. The load capacity (8,609.4 kWh/day) for the temperature TMDL was determined by converting canopy cover targets to solar radiation.

Estimates of Existing Pollutant Loads

The estimated load for the temperature TMDL to be completed on Little Beaver Creek is elevated above the load capacity of the water body. The existing load (32,597.6 kWh/day) for temperature TMDLs was calculated as the sum of the amount of solar radiation for the segments of the creek. These values represent the estimated existing load of pollutant occurring in the water body.

Load Allocation

The wasteload allocation for Little Beaver Creek is limited to construction storm water wasteload allocations. Wasteload allocations are not made for construction storm water for a temperature TMDL based on canopy cover.

Background, MOS, and FG are values attributed to the watershed that are beyond human control, provide some flexibility (due to uncertainty) within the watershed, and allow for future growth within the watershed. Background loads, MOS, and FG are not determined for a temperature TMDL because the canopy cover targets are set for natural potential vegetation.

The final load allocation for nonpoint source activity is determined by reducing the load capacity of the water body by the wasteload allocations, background, MOS, and FG values. Therefore, the load allocation for temperature in Little Beaver Creek is 8,609.4 kWh/day.

Table 78. Little Beaver Creek load reductions.

Pollutant	Critical flow (cfs)	Target	Load capacity	Existing Load	Percent reduction
temperature	5.8	85-75	8,609.4	32,597.6	73.6

[a]Temperature – target measured in percent canopy cover, load capacity and existing load measured in kWh/day.

Table 79. Little Beaver Creek load allocations.

Pollutant	MOS	BG	FG	Available Load	Wasteload allocation	Load Allocation
Temperature (kWh/day)	n.a.	n.a.	n.a.	8,609.4	0.0	8,609.4

[a]Background (BG), Margin of safety (MOS) and Future growth (FG), n.a.-not applicable.

Camp Creek

Through the subbasin assessment process, it has been identified that the water quality of Camp Creek is impacted by pollutants. The pollutants of concern in the water body have been found to be sediment and temperature. For a summary of load reductions for this water body see Table 80, for load allocations see Table 81, and for segmental breakdown of stream bank erosion values see Table 82.

Lack of flow is the largest impact to beneficial uses of Camp Creek. Camp Creek is impaired due to a lack of flow; however, EPA does not believe that flow (or lack of flow) is a pollutant as defined by CWA Section 502(6). Since TMDLs are not required to be established for water bodies impaired by pollution, a TMDL has not been established for Camp Creek for flow.

Design Conditions

Sediment impacts a water body during higher flow events, when the carrying capacity of the stream is greater and erosion is more likely to occur. Typically the higher flow events occur during spring runoff or periodically during storm situations; as a result the critical period for sediment on Camp Creek has been identified as occurring from March to May. During this period the critical flow for the water body based on the predicted hydrograph is 7.3 cfs. As sediment has been found to be occurring as a result of stream bank erosion, the critical flow period is less important in the development of stream bank stability TMDLs.

Solar radiation impacts the temperature of a water body during the late spring and summer months, when canopy cover is the major component that maintains cooler water temperatures. As a result, the critical period for temperature on Camp Creek has been identified as occurring from April to September. During this time, the critical flow for the water body, based on the predicted hydrograph, is 1.5 cfs. As a temperature TMDL targets canopy cover of a creek, the critical flow is less important in the development of a temperature TMDL.

Target Selection

Target selections are discussed in more complete detail in the subbasin assessment (SBA) portion of this document under the section *Analysis Process* (page 45). The water quality standards for the various pollutants can also be viewed in Appendix 3.

Sediment is impacting beneficial uses of Camp Creek in the form of bedload sediment. Suspended sediment measured during drought years is not impacting water quality of the stream, but bedload sediment measured in the form of percent fines indicates that sediment is impacting water quality. A value greater than 35% for percent fines was used to indicate that sediment was impacting the water body. If this was the case then stream bank erosion inventories were completed to determine if stream bank erosion was the contributor of sediment impact. The target for stream bank erosion is 80% bank stability.

Temperature is impacting the water quality of Camp Creek, and canopy cover is the method used to determine the amount of solar radiation the creek is receiving. Vegetation type and bankfull width were used to characterize the creek, then the Alvord Lake TMDL was used to aid in target selection based on these values (Table 45, page 100). The targets for the sections of the water bodies are as follows: upper (75%), upper middle (35%), lower middle (65%), and lower portions (50%). If the aerial photo estimates are less than the appropriate canopy cover target, canopy cover needs to be improved within the segment. Aerial photo estimations likely underestimate segments that have higher cover and overestimate segments that have lower cover; however, in terms of the creek as a whole, these balance themselves out. This should be taken into account however during the implementation phase; the more critical areas are likely to be the areas with the least amount of canopy cover.

Monitoring Points

As a stream bank erosion TMDL is site specific and can not be measured by a pour point value as some of the other constituents can there is no monitoring point to be measured for identification. One possible way of tracking changes within the system would be various Wohlman pebble counts in locations that have been used in the past. For the stream bank erosion TMDL the water body has been divided into five segments. These segments are as follows: upper, upper lower, middle, middle lower, and lower.

The monitoring point for temperature collection for TMDL development occurred about half a mile upstream of the mouth and 2.5 miles downstream of the headwaters. Both sites can be used to identify further trends within the system; however, the site upstream of the mouth should be used to determine if water quality standards on Camp Creek are being met.

Load Capacity

The load capacities of the two TMDLs to be completed on Camp Creek have been determined in different ways.

- The load capacity (89.4 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability.
- The load capacity (256,830.2 kWh/day) for the temperature TMDL was determined by converting canopy cover targets to solar radiation.

These values represent the estimated quantity of pollutant the water bodies are believed to be able to assimilate and still maintain beneficial uses full support status and meet water quality standards.

Estimates of Existing Pollutant Loads

The estimated existing loads for the two TMDLs to be completed on Camp Creek are elevated above the load capacity of the water body:

- The existing load (278.3 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability.
- The existing load (320,219.8 kWh/day) for temperature TMDLs was calculated as the sum of the amount of solar radiation for the segments of the creek.

These values represent the estimated existing loads of pollutant occurring in the water body.

Load Allocation

The wasteload allocation for Camp Creek is limited to construction storm water wasteload allocations. The wasteload allocation for construction storm water was determined by allocating 2% of the load capacity to construction storm water. As this is the only point source in the watershed the allocation for sediment is 1.5 t/yr. Wasteload allocations are not made for construction storm water for a temperature TMDL based on canopy cover.

Background, MOS, and FG are values attributed to the watershed that are beyond human control, provide some flexibility within the watershed, and allow for future growth within the watershed. Calculations for each of these components were determined in various ways:

- Background loads are not determined for a stream bank erosion TMDL because it is implied that background loads occur within the target.
- Background loads, MOS, and FG are not determined for a temperature TMDL because the canopy cover targets are set for natural potential vegetation.
- The MOS for the sediment TMDL for Camp Creek is 10% of the load capacity (8.9 t/yr).
- The FG for the sediment TMDL for Camp Creek is 5% of the load capacity (4.5 t/yr).

The final load allocations for nonpoint source activity are determined by reducing the load capacity of the water body by the wasteload allocations, background, and MOS values. Therefore, the load allocation for sediment is 74.5 t/yr and for temperature is 193,274.4 kWh/day.

Table 80. Camp Creek load reductions.

Pollutant	Critical flow (cfs)	Target	Load capacity	Existing Load	Percent reduction
sediment	7.3	80	89.4	278.3	67.9
temperature	1.5	75-35-65-50	256,830.2	320,219.8	19.8

[a]Sediment- target measured in percent bank stability, load capacity and existing load measured in t/yr.
[b]Temperature – target measured in percent canopy cover, load capacity and existing load measured in kWh/day.

Table 81. Camp Creek load allocations.

Pollutant	MOS	BG	FG	Available Load	Wasteload allocation	Load Allocation
sediment (t/yr)	8.9	implicit	4.5	76.0	1.5	74.5
Temperature (kWh/day)	n.a.	n.a.	n.a.	256,830.2	0.0	256,830.2

[a]Implicit- Background (BG) is implied within the target.
[b]Margin of safety (MOS) and Future growth (FG), n.a.-not applicable.

Table 82. Camp Creek stream bank erosion values.

Reach	Existing Erosion rate	Proposed Erosion rate	Existing Total Erosion	Proposed Total Erosion	Erosion Rate Percent Reduction	Percent of Existing Total Load
Upper	9.5	5.2	29.3	16.1	45	11
Lower upper	36.8	4.8	45.4	5.9	87	16
Middle	9.7	6.3	50.7	32.9	35	18
Lower middle	39.4	6.8	101.5	17.5	83	36
Lower	35.9	11.9	51.5	17.1	67	19
Total			278.3	89.4		

[a]See Appendix 4 for site descriptions
[b]Erosion rates measured in tons/mile/year. Total erosion measured in tons/year.

Reasonable Assurance

There is reasonable assurance that implementation as the next step of the water body management process will occur. First this document includes implementation strategies that are in the subsequent pages. Idaho's water quality standards identify designated agencies that are responsible for evaluating and modifying best management practices to protect impaired water bodies. The state has committed itself to having implementation plans developed within 18 months of approval of the TMDL document. DEQ, the WAG, and the designated agencies will develop implementation plans, and DEQ will incorporate them into the states water quality management plan. Also in measuring the effectiveness of an implementation activity, DEQ will reassess the support status of the water body to determine if the water body has reached full support status. If full support status has not been obtained then further implementation will be necessary and further reassessment completed until full support status is completed. If full support status is completed then the requirements of the TMDL will be considered completed.

Elk Creek

Through the subbasin assessment process, it has been identified that the water quality of Elk Creek is being impacted by a pollutant. The pollutant of concern in the water body has been found to be sediment. For a summary of load reductions for this water body see Table 83, for load allocations see Table 84, and for segmental breakdown of stream bank erosion values see Table 85.

Lack of flow is the largest impact to beneficial uses of Elk Creek. Elk Creek is impaired due to a lack of flow; however, EPA does not believe that flow (or lack of flow) is a pollutant as defined by CWA Section 502(6). Since TMDLs are not required to be established for water bodies impaired by pollution, a TMDL has not been established for Elk Creek for flow.

Design Conditions

Sediment impacts a water body during higher flow events, when the carrying capacity of the stream is greater and erosion is more likely to occur. Typically the higher flow events occur during spring runoff or periodically during storm situations; as a result the critical period for sediment on Elk Creek has been identified as occurring from March to May. During this period the critical flow for the water body based on predicted hydrograph is 5.0 cfs. As sediment has been found to be occurring as a result of stream bank erosion the critical flow period is less important in the development of stream bank stability TMDLs.

Target Selection

Target selections are discussed in more complete detail in the subbasin assessment (SBA) portion of this document under the section *Analysis Process* (page 45). The water quality standards for the various pollutants can also be viewed in Appendix 3.

Sediment is impacting water quality of Elk Creek in the form of bedload sediment. Suspended sediment measured during drought years is not impacting water quality of the stream, however bedload sediment measured in the form of percent fines indicates that sediment is impacting water quality. A value greater than 35% for percent fines was used to indicate that sediment was impacting the water body. If this was the case then stream bank erosion inventories were completed to determine if stream bank erosion was the contributor of sediment impact. As a result if TMDLs for stream bank erosion are completed the target is for 80% bank stability.

Monitoring Points

As a stream bank erosion TMDL is site specific and can not be measured by a pour point value as some of the other constituents can there is no monitoring point to be measured for identification. One possible way of tracking changes within the system would be various

Wohlman pebble counts in locations that have been used in the past. For the stream bank erosion TMDL the water body has been divided into two segments. These segments are as follows: upper and lower.

Load Capacity

The load capacity estimates the quantity of pollutant the water body is believed to be able to assimilate and still maintain beneficial use full support status and meet water quality standards. Load capacity (63.6 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability.

Estimates of Existing Pollutant Loads

The estimated existing load for the sediment TMDL to be completed on Elk Creek is elevated above the load capacity of the water body. The existing load (142.1 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability. This value represents the estimated existing loads of pollutant occurring in the water body.

Load Allocation

The wasteload allocation for Elk Creek is limited to construction storm water wasteload allocations. The wasteload allocation for construction storm water was determined by allocating 2% of the load capacity to construction storm water. As this is the only point source in the watershed the wasteload allocation for sediment is 1.1 t/yr.

Background, MOS, and FG are values attributed to the watershed that are beyond human control, provide some flexibility within the watershed, and allow for future growth within the watershed. Calculations for each of these components were determined in various ways:

- Background loads are not determined for a stream bank erosion TMDL because it is implied that background loads occur within the target.
- The MOS for the sediment TMDL of Elk Creek is 10% of the load capacity (6.4 t/yr).
- The FG for the sediment TMDL of Elk Creek is 5% of the load capacity (3.2 t/yr).

The final load allocation for nonpoint source activity is determined by reducing the load capacity of the water body by the wasteload allocations, background, MOS, and FG values. *Therefore, the load allocation for sediment is 53.0 t/yr.*

Table 83. Elk Creek load reductions.

Pollutant	Critical flow (cfs)	Target	Load capacity	Existing Load	Percent reduction
sediment	5.0	80	63.6	142.1	55.2

[a]Sediment- target measured in percent bank stability, load capacity and existing load measured in t/yr.

Table 84. Elk Creek load allocations.

Pollutant	MOS	BG	FG	Available Load	Wasteload allocation	Load Allocation
Sediment (t/yr)	6.4	implicit	3.2	54.1	1.1	53.0

[a]Implicit- Background (BG) is implied within the target, Margin of safety (MOS) and Future growth (FG).

Table 85. Elk Creek stream bank erosion values.

Reach	Existing Erosion rate	Proposed Erosion rate	Existing Total Erosion	Proposed Total Erosion	Erosion Rate Percent Reduction	Percent of Existing Total Load
Lower	14.1	4.3	60.9	18.4	70	43
Upper	13.0	7.2	81.3	45.1	44	57
Total			142.1	63.6		

[a]See Appendix 4 for site descriptions
[b]Erosion rates measured in tons/mile/year. Total erosion measured in tons/year.

Reasonable Assurance

There is reasonable assurance that implementation as the next step of the water body management process will occur. First this document includes implementation strategies that are in the subsequent pages. Idaho's water quality standards identify designated agencies that are responsible for evaluating and modifying best management practices to protect impaired water bodies. The state has committed itself to having implementation plans developed within 18 months of approval of the TMDL document. DEQ, the WAG, and the designated agencies will develop implementation plans, and DEQ will incorporate them into the states water quality management plan. Also in measuring the effectiveness of an implementation activity, DEQ will reassess the support status of the water body to determine if the water body has reached full support status. If full support status has not been obtained then further implementation will be necessary and further reassessment completed until full support status is completed. If full support status is completed then the requirements of the TMDL will be considered completed.

Corral Creek

Through the subbasin assessment process, it has been identified that the water quality of Corral Creek is being impacted by pollutants. The pollutants of concern in the water body have been found to be sediment and temperature. For a summary of load reductions for this water body see Table 86, for load allocations see Table 87, and for segmental breakdown of stream bank erosion values see Table 88.

Lack of flow is the largest impact to beneficial uses of Corral Creek. Corral Creek is impaired due to a lack of flow; however, EPA does not believe that flow (or lack of flow) is a pollutant as defined by CWA Section 502(6). Since TMDLs are not required to be established for water bodies impaired by pollution, a TMDL has not been established for Corral Creek for flow.

Design Conditions

Sediment impacts a water body during higher flow events, when the carrying capacity of the stream is greater and erosion is more likely to occur. Typically the higher flow events occur during spring runoff or periodically during storm situations; as a result the critical period for sediment on Corral Creek has been identified as occurring from March to May. During this period the critical flow for the water body based on predicted hydrograph is 42.4 cfs. As sediment has been found to be occurring as a result of stream bank erosion the critical flow period is less important in the development of stream bank stability TMDLs.

Solar radiation impacts the temperature of a water body during the late spring and summer months, when canopy cover is the major component that maintains cooler water temperatures. As a result the critical period for temperature on Corral Creek has been identified as occurring from April to September. During this time, the critical flow for the water body, based on the predicted hydrograph, is 20.4 cfs. As a temperature TMDL targets canopy cover of a creek, the critical flow is less important in the development of a temperature TMDL.

Target Selection

Target selections are discussed in more complete detail in the subbasin assessment (SBA) portion of this document under the section *Analysis Process* (page 45). The water quality standards for the various pollutants can also be viewed in Appendix 3.

Sediment is impacting water quality of Corral Creek in the form of bedload sediment. Suspended sediment measured during drought years is not impacting water quality of the stream, however bedload sediment measured in the form of percent fines indicates that sediment is impacting water quality. A value greater than 35% for percent fines was used to indicate that sediment was impacting the water body. If this was the case then stream bank erosion inventories were completed to determine if stream bank erosion was a contributor of sediment impact. The target for stream bank erosion is 80% bank stability.

Temperature is impacting the water quality of Corral Creek and canopy cover is the method used to determine the amount of solar radiation the creek is receiving. Vegetation type and bankfull width were used to characterize the creek, then the Alvord Lake TMDL was used to aid in target selection based on these values (Table 51). The target for the water body is 50%. If the aerial photo estimates are less than the appropriate canopy cover target, canopy cover needs to be improved within the segment. Aerial photo estimations likely underestimate segments that have higher cover and overestimate segments that have lower cover, however in terms of the creek as a whole, these balance themselves out. This should be taken into account however during the implementation phase; the more critical areas are likely to be the areas with the least amount of canopy cover.

Monitoring Points

As a stream bank erosion TMDL is site specific and can not be measured by a pour point value as some of the other constituents can there is no monitoring point to be measured for identification. One possible way of tracking changes within the system would be various Wohlman pebble counts in locations that have been used in the past. For the stream bank erosion TMDL the water body has been divided into two segments. These segments are as follows: upper and lower.

The monitoring point for temperature collection for TMDL development occurred about 1.5 miles upstream of the mouth and about half a mile downstream of the East and West Forks of Corral Creek. Both sites can be used to identify further trends within the system; however the lower site upstream of the mouth should be used to determine if water quality standards on Corral Creek are being met.

Load Capacity

The load capacities of the two TMDLs to be completed on Corral Creek have been determined in different ways.

- The load capacity (35.8 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability.
- The load capacity (201,544.2 kWh/day) for the temperature TMDL was determined by converting canopy cover targets to solar radiation.

These values represent the estimated quantity of pollutant the water bodies are believed to be able to assimilate and still maintain beneficial uses full support status and meet water quality standards.

Estimates of Existing Pollutant Loads

The estimated existing loads for the two TMDLs to be completed on Corral Creek are elevated above the load capacity of the water body:

- The existing load (121.5 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability.
- The existing load (322,974.6 kWh/day) for temperature TMDLs was calculated as the sum of the amount of solar radiation for the segments of the creek.

These values represent the estimated existing load of pollutant occurring in the water body.

Load Allocation

The wasteload allocation for Corral Creek is limited to construction storm water wasteload allocations. The wasteload allocation for construction storm water was determined by allocating 2% of the load capacity to construction storm water. As this is the only point source in the watershed the allocation for sediment is 0.6 t/yr. Wasteload allocations are not made for construction storm water for a temperature TMDL based on canopy cover.

Background, MOS, and FG are values attributed to the watershed that are beyond human control, provide some flexibility within the watershed, and allow for future growth within the watershed. Calculations for each of these components were determined in various ways:

- Background loads are not determined for a stream bank erosion TMDL because it is implied that background loads occur within the target.
- Background loads, MOS, and FG are not determined for a temperature TMDL because the canopy cover targets are set for natural potential vegetation.
- The MOS for the sediment TMDL for Corral Creek is 10% of the load capacity (3.6 t/yr).
- The FG for the sediment TMDL for Corral Creek is 5% of the load capacity (1.8 t/yr).

The final load allocations for nonpoint source activity are determined by reducing the load capacity of the water body by the wasteload allocations, background, MOS, and FG values. Therefore, the load allocation for sediment is 29.8 t/yr and for temperature is 201,544.2 kWh/day.

Table 86. Corral Creek load reductions.

Pollutant	Critical flow (cfs)	Target	Load capacity	Existing Load	Percent reduction
sediment	42.4	80	35.8	121.5	70.5
temperature	20.4	50	201,544.2	322,974.6	37.6

[a]Sediment- target measured in percent bank stability, load capacity and existing load measured in t/yr.
[b]Temperature – target measured in percent canopy cover, load capacity and existing load measured in kWh/day.

Table 87. Corral Creek load allocations.

Pollutant	MOS	BG	FG	Available Load	Wasteload allocation	Load Allocation
Sediment (t/yr)	3.6	implicit	1.8	30.4	0.6	29.8
Temperature (kWh/day)	n.a.	n.a.	n.a.	201,544.2	0.0	201,544.2

[a]Implicit- Background (BG) is implied within the target.
[b]Margin of safety (MOS) and Future growth (FG), n.a.-not applicable.

Table 88. Corral Creek stream bank erosion values.

Reach	Existing Erosion rate	Proposed Erosion rate	Existing Total Erosion	Proposed Total Erosion	Erosion Rate Percent Reduction	Percent of Existing Total Load
Upper	5.2	3.4	22.3	14.7	34	18
Lower	24.2	5.1	99.2	21.0	79	82
Total			121.5	35.8		

[a]See Appendix 4 for site descriptions
[b]Erosion rates measured in tons/mile/year. Total erosion measured in tons/year.

Reasonable Assurance

There is reasonable assurance that implementation as the next step of the water body management process will occur. First this document includes implementation strategies that are in the subsequent pages. Idaho's water quality standards identify designated agencies that are responsible for evaluating and modifying best management practices to protect impaired water bodies. The state has committed itself to having implementation plans developed within 18 months of approval of the TMDL document. DEQ, the WAG, and the designated agencies will develop implementation plans, and DEQ will incorporate them into the states water quality management plan. Also in measuring the effectiveness of an implementation activity, DEQ will reassess the support status of the water body to determine if the water body has reached full support status. If full support status has not been obtained then further implementation will be necessary and further reassessment completed until full support status is completed. If full support status is completed then the requirements of the TMDL will be considered completed.

Cow Creek above the Reservoir

Through the subbasin assessment process, it has been identified that the water quality of Cow Creek above the reservoir is being impacted by pollutants. The pollutants of concern in the water body have been found to be sediment and nutrients. Nutrients are not impacting this segment of Cow Creek; however as the creek discharges into a reservoir a TMDL will be completed to limit nutrient delivery to the reservoir. For a summary of load reductions for this water body see Table 89, for load allocations see Table 90, and for segmental breakdown of stream bank erosion values see Table 91.

Design Conditions

Sediment impacts a water body during higher flow events, when the carrying capacity of the stream is greater and erosion is more likely to occur. Typically the higher flow events occur during spring runoff or periodically during storm situations; as a result the critical period for sediment on Cow Creek has been identified as occurring from March to May. During this period the critical flow for the water body based on the predicted hydrograph is 7.8 cfs. As sediment has been found to be occurring as a result of stream bank erosion the critical flow period is less important in the development of stream bank stability TMDLs.

Nutrients in a water body that is delivering to a storage system are more likely to impact a reservoir when the creek is delivering water to the reservoir as the reservoir acts as a sink and drops nutrients out of the water column. As a result the critical period for nutrients for Cow Creek is from March to June, and the critical flow for this period based on the predicted hydrograph is 6.4 cfs. The average flow during the critical period aids in determining the loading capacity of the water body.

Target Selection

Target selections are discussed in more complete detail in the subbasin assessment (SBA) portion of this document under the section *Analysis Process* (page 45). The water quality standards for the various pollutants can also be viewed in Appendix 3.

Sediment is impacting the water quality of Cow Creek in the form of bedload sediment. Suspended sediment measured during drought years is not impacting water quality of the stream, however bedload sediment measured in the form of percent fines indicates that sediment is impacting water quality. A value greater than 35% for percent fines was used to indicate that sediment was impacting the water body. If this was the case then stream bank erosion inventories were completed to determine if stream bank erosion was the contributor of sediment impact. The target for stream bank erosion TMDLs is for 80% bank stability.

Nutrients are not impacting the water quality of Cow Creek, but as the creek discharges into a reservoir a TMDL is completed to limit nutrient delivery. The target for water bodies discharging into a storage system is 0.050 mg/L. This goal should aid limiting excessive delivery of nutrients to the reservoir. As a result 0.050 mg/L is the target to be used in the development of a nutrient TMDL for Cow Creek.

Monitoring Points

As a stream bank erosion TMDL is site specific and can not be measured by a pour point value as some of the other constituents can there is no monitoring point to be measured for identification. One possible way of tracking changes within the system would be various Wohlman pebble counts in locations that have been used in the past. For the stream bank erosion TMDL the water body has been divided into three segments. These segments are as follows: upper, middle, and lower.

The monitoring point for nutrient collection for TMDL development was located at the road crossing upstream of the reservoir. This site was located approximately a quarter of a mile upstream of the reservoir. This site should be used to identify further trends or to assess the water body in the future.

Load Capacity

The load capacities of the two TMDLs to be completed on Cow Creek have been determined in different ways.

- The load capacity for (1.72 lbs/day) for nutrient TMDLs was calculated based on target selection and average critical flow.
- The load capacity (15.5 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability.

These values represent the estimated quantity of pollutant the water bodies are believed to be able to assimilate and still maintain beneficial uses full support status and meet water quality standards.

Estimates of Existing Pollutant Loads

The estimated existing loads for the two TMDLs to be completed on Cow Creek are elevated above the load capacity of the water body:

- The existing load (4.0 lbs/day) for nutrient TMDLs was calculated based on average annual values of TP and average critical flow.
- The existing load (81.5 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability.

These values represent the estimated existing load of pollutant occurring in the water body.

Load Allocation

The wasteload allocation for Cow Creek (above the reservoir) is limited to construction storm water wasteload allocations. The wasteload allocation for construction storm water was determined by allocating 2% of the load capacity to construction storm water. As this is the only point source in the watershed the allocation for nutrients is 0.02 lbs/day and for sediment is 0.3 t/yr.

Background, MOS, and FG are values attributed to the watershed that are beyond human control, provide some flexibility within the watershed, and allow for future growth within the watershed. Calculations for each of these components were determined in various ways:

- Background for TP has been established as being 0.02 mg/L, which accounts for a load allocation of 0.7 lbs/day.
- Background loads are not determined for a stream bank erosion TMDL because it is implied that background loads occur within the target.
- The MOS for the TMDLs for Cow Creek is 10% of the load capacity, for nutrients 0.17 lbs/day and for sediment 1.6 t/yr.
- The FG for the TMDLs for Cow Creek is 5% of the load capacity, for nutrients 0.09 lbs/day and for sediment 0.8 t/yr.

The final load allocations for nonpoint source activity are determined by reducing the load capacity of the water body by the wasteload allocations, background, and MOS values. Therefore, the load allocation for nutrients is 0.76 lbs/day and for sediment is 12.9 t/yr.

Table 89. Cow Creek load reductions.

Pollutant	Critical flow (cfs)	Target	Load capacity	Existing Load	Percent reduction
sediment	7.8	80	15.5	81.5	81.0
nutrients	6.4	0.05	1.72	4.0	56.5

[a]Sediment- target measured in percent bank stability, load capacity and existing load measured in t/yr.
[b]Nutrients – target measured in mg/L, load capacity and existing load measured in lbs/day.

Table 90. Cow Creek load allocations.

Pollutant	MOS	BG	FG	Available Load	Wasteload allocation	Load Allocation
Sediment (t/yr)	1.6	implicit	0.8	13.2	0.3	12.9
Nutrient (lbs/day)	0.17	0.7	0.09	0.78	0.02	0.76

[a]Implicit- Background (BG) is implied within the target, Margin of safety (MOS) and Future growth (FG).

Table 91. Cow Creek stream bank erosion values.

Reach	Existing Erosion rate	Proposed Erosion rate	Existing Total Erosion	Proposed Total Erosion	Erosion Rate Percent Reduction	Percent of Existing Total Load
Upper	2.6	1.8	2.2	1.6	30	3
Middle	66.8	11.0	75.5	12.4	84	93
Lower	4.1	1.7	3.8	1.5	60	5
Total			81.5	15.5		

[a]See Appendix 4 for site descriptions
[b]Erosion rates measured in tons/mile/year. Total erosion measured in tons/year.

Reasonable Assurance

There is reasonable assurance that implementation as the next step of the water body management process will occur. First this document includes implementation strategies that are in the subsequent pages. Idaho's water quality standards identify designated agencies that are responsible for evaluating and modifying best management practices to protect impaired water bodies. The state has committed itself to having implementation plans developed within 18 months of approval of the TMDL document. DEQ, the WAG, and the designated agencies will develop implementation plans, and DEQ will incorporate them into the states water quality management plan. Also in measuring the effectiveness of an implementation activity, DEQ will reassess the support status of the water body to determine if the water body has reached full support status. If full support status has not been obtained then further implementation will be necessary and further reassessment completed until full support status is completed. If full support status is completed then the requirements of the TMDL will be considered completed.

Wild Horse Creek

Through the subbasin assessment process, it has been identified that the water quality of Wild Horse Creek is being impacted by pollutants. The pollutants of concern in the water body have been found to be sediment, bacteria, and temperature. For a summary of load reductions for this water body see Table 92, for load allocations see Table 93, and for segmental breakdown of stream bank erosion values see Table 94.

Lack of flow and channelization are the largest impact to beneficial uses of Wild Horse Creek. Wild Horse Creek is impaired due to a lack of flow; however, EPA does not believe that flow (or lack of flow) is a pollutant as defined by CWA Section 502(6). Since TMDLs are not required to be established for water bodies impaired by pollution, a TMDL has not been established for Wild Horse Creek for flow.

Design Conditions

Sediment impacts a water body during higher flow events, when the carrying capacity of the stream is greater and erosion is more likely to occur. Typically the higher flow events occur during spring runoff or periodically during storm situations; as a result the critical period for sediment on Wild Horse Creek has been identified as occurring from March to May. During this period the critical flow for the water body based on predicted hydrograph is 4.9 cfs. As sediment has been found to be occurring as a result of stream bank erosion the critical flow period is less important in the development of stream bank stability TMDLs.

Bacteria are more likely to impact a water body during lower base flow events, when flushing events are not occurring. The critical period as a result is from June to September, and the critical flow for this period based on predicted hydrograph is 1.5 cfs. The flow of Wild Horse Creek during the critical period is less critical in determining load capacity of the stream, as water quality standards set the limit for contact recreation beneficial uses. However, these critical periods are the time when impacts are more critical.

Solar radiation impacts the temperature of a water body during the late spring and summer months, when canopy cover is the major component that maintains cooler water temperatures. As a result the critical period for temperature on Wild Horse Creek has been identified as occurring from April to September. During this time, the critical flow for the water body, based on the predicted hydrograph, is 2.3 cfs. As a temperature TMDL targets canopy cover of a creek, the critical flow is less important in the development of a temperature TMDL.

Target Selection

Target selections are discussed in more complete detail in the subbasin assessment (SBA) portion of this document under the section *Analysis Process* (page 45). The water quality standards for the various pollutants can also be viewed in Appendix 3.

Sediment is impacting water quality of Wild Horse Creek in the form of bedload sediment. Suspended sediment measured during drought years is not impacting water quality of the stream, however bedload sediment measured in the form of percent fines indicates that sediment is impacting water quality. A value greater than 35% for percent fines was used to indicate that sediment was impacting the water body. If this was the case then stream bank erosion inventories were completed to determine if stream bank erosion was the contributor of sediment impact. The target for stream bank erosion TMDLs is 80% bank stability.

Bacteria are impacting the secondary contact recreation beneficial uses of Wild Horse Creek and are measured by *E. coli* values. According to Idaho Code 58.01.02.251.02a, waters with secondary contact recreation use are not to exceed 576 colonies of *E. coli* organisms per 100ml of sample. If an exceedance of this value occurs then a four additional samples have to be taken within the 30 day period and must not exceed a geometric mean of 126 cfu/100ml. As a result 576 colonies of *E. coli* organisms will be the target for the bacteria TMDL on Wild Horse Creek. However, the geometric mean value of 126 cfu/100 ml will be the value used to determine compliance with the standards.

Temperature is impacting the water quality of Wild Horse Creek and canopy cover is the method used to determine the amount of solar radiation the creek is receiving. Vegetation type and bankfull width were used to characterize the creek, then the Alvord Lake TMDL was used to aid in target selection based on these values (Table 56). The target for the water body is 50%. If the aerial photo estimates are less than the appropriate canopy cover target, canopy cover needs to be improved within the segment. Aerial photo estimations likely underestimate segments that have higher cover and overestimate segments that have lower cover, however in terms of the creek as a whole, these balance themselves out. This should be taken into account however during the implementation phase; the more critical areas are likely to be the areas with the least amount of canopy cover.

Monitoring Points

As a stream bank erosion TMDL is site specific and can not be measured by a pour point value as some of the other constituents can there is no monitoring point to be measured for identification. One possible way of tracking changes within the system would be various Wohlman pebble counts in locations that have been used in the past. For the stream bank erosion TMDL the water body has been divided into three segments. These segments are as follows: upper, middle, and lower.

The monitoring point for bacteria collection for TMDL development was located at the upper end of the lower segment of Wild Horse Creek. This site was located approximately two miles upstream of the mouth, at the road crossing downstream of the highway. This site should be used to identify further trends or to assess secondary contact recreation beneficial uses within the water body in the future.

The monitoring point for temperature collection for TMDL development occurred about one mile upstream of the mouth. This site can be used to identify further trends within the system, and should also be used to determine if water quality standards on Wild Horse Creek are being met.

Load Capacity

The load capacities of the three TMDLs to be completed on Wild Horse Creek have been determined in different ways.

- The load capacity (576 cfu/100ml) for bacteria TMDLs was set at values set by the instantaneous water quality standards for secondary contact recreation.
- The load capacity (18.3 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability.
- The load capacity (169,873.0 kWh/day) for the temperature TMDL was determined by converting canopy cover targets to solar radiation.

These values represent the estimated quantity of pollutant the water bodies are believed to be able to assimilate and still maintain beneficial uses full support status and meet water quality standards.

Estimates of Existing Pollutant Loads

The estimated existing loads for the three TMDLs to be completed on Wild Horse Creek are elevated above the load capacity of the water body:

- The existing load (2500 cfu/100ml) for bacteria TMDLs was set at the values elevated above secondary contact recreation water quality standards.
- The existing load (46.5 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability.
- The existing load (283,983.3 kWh/day) for temperature TMDLs was calculated as the sum of the amount of solar radiation for the segments of the creek.

These values represent the estimated existing load of pollutant occurring in the water body.

Load Allocation

The wasteload allocation for Wild Horse Creek is limited to construction storm water wasteload allocations. The wasteload allocation for construction storm water was determined by allocating 2% of the load capacity to construction storm water. As this is the only point source in the watershed the allocation for bacteria is 9.8 cfu/100ml and for sediment is 0.3 t/yr. Wasteload allocations are not made for construction storm water for a temperature TMDL based on canopy cover.

Background, MOS, and FG are values attributed to the watershed that are beyond human control, provide some flexibility within the watershed, and allow for future growth within the watershed. Calculations for each of these components were determined in various ways:

- The winter months were observed to determine the background levels of bacteria in the watershed, background is 2 cfu/100ml.
- Background loads are not determined for a stream bank erosion TMDL because it is implied that background loads occur within the target.
- Background loads, MOS, and FG are not determined for a temperature TMDL because the canopy cover targets are set for natural potential vegetation.
- The MOS for the TMDLs for Wild Horse Creek is 10% of the load capacity, for bacteria 57.6 cfu/100ml and for sediment 1.8 t/yr.
- The FG for the TMDLs for Wild Horse Creek is 5% of the load capacity, for bacteria 28.8 cfu/100ml and for sediment 0.9 t/yr.

The final load allocations for nonpoint source activity are determined by reducing the load capacity of the water body by the wasteload allocations, background, MOS, and FG values. Therefore, the load allocation for bacteria is 477.8 cfu/100ml, for sediment is 15.2 t/yr, and for temperature is 169,873.0 kWh/day.

Table 92. Wild Horse Creek load reductions.

Pollutant	Critical flow (cfs)	Target	Load capacity	Existing Load	Percent reduction
sediment	4.9	80	18.3	46.5	60.6
bacteria	1.5	576	576	2,500	77.0
temperature	2.3	50	169,873.0	283,983.3	40.2

[a]Sediment- target measured in percent bank stability, load capacity and existing load measured in t/yr.
[b]Bacteria- target, load capacity, existing load measured in cfu/100ml.
[c]Temperature – target measured in percent canopy cover, load capacity and existing load measured in kWh/day.

Table 93. Wild Horse Creek load allocations.

Pollutant	MOS	BG	FG	Available Load	Wasteload allocation	Load Allocation
Sediment (t/yr)	1.8	implicit	0.9	15.6	0.3	15.2
Bacteria (cfu/100ml)	57.6	2	28.8	487.6	9.8	477.8
Temperature (kWh/day)	n.a.	n.a.	n.a.	169,873.0	0.0	169,873.0

[a]Implicit- Background (BG) is implied within the target.
[b]Margin of safety (MOS) and Future growth (FG), n.a.-not applicable.

Table 94. Wild Horse Creek stream bank erosion values.

Reach	Existing Erosion rate	Proposed Erosion rate	Existing Total Erosion	Proposed Total Erosion	Erosion Rate Percent Reduction	Percent of Existing Total Load
Upper	0.1	0.5	0.1	1.1	0	0.3
Middle	1.7	1.9	4.5	5.0	0	9.6
Lower	10.6	3.1	41.9	12.2	71	90
Total			46.5	18.3		

[a]See Appendix 4 for site descriptions
[b]Erosion rates measured in tons/mile/year. Total erosion measured in tons/year.

Reasonable Assurance

There is reasonable assurance that implementation as the next step of the water body management process will occur. First this document includes implementation strategies that are in the subsequent pages. Idaho's water quality standards identify designated agencies that are responsible for evaluating and modifying best management practices to protect impaired water bodies. The state has committed itself to having implementation plans developed within 18 months of approval of the TMDL document. DEQ, the WAG, and the designated agencies will develop implementation plans, and DEQ will incorporate them into the states water quality management plan. Also in measuring the effectiveness of an implementation activity, DEQ will reassess the support status of the water body to determine if the water body has reached full support status. If full support status has not been obtained then further implementation will be necessary and further reassessment completed until full support status is completed. If full support status is completed then the requirements of the TMDL will be considered completed.

McKinney Creek

Through the subbasin assessment process, it has been identified that the water quality of McKinney Creek is being impacted by a pollutant. The pollutant of concern in the water body has been found to be sediment. For a summary of load reductions for this water body see Table 95, for load allocations see Table 96, and for segmental breakdown of stream bank erosion values see Table 97.

Lack of flow is also an impact to beneficial uses of McKinney Creek. McKinney Creek is impaired due to a lack of flow; however, EPA does not believe that flow (or lack of flow) is a pollutant as defined by CWA Section 502(6). Since TMDLs are not required to be established for water bodies impaired by pollution, a TMDL has not been established for McKinney Creek for flow.

Design Conditions

Sediment impacts a water body during higher flow events, when the carrying capacity of the stream is greater and erosion is more likely to occur. Typically the higher flow events occur during spring runoff or periodically during storm situations; as a result the critical period for sediment on McKinney Creek has been identified as occurring from March to May. During this period the critical flow for the water body based on predicted hydrograph is 2.5 cfs. As sediment has been found to be occurring as a result of stream bank erosion the critical flow period is less important in the development of stream bank stability TMDLs.

Target Selection

Target selections are discussed in more complete detail in the subbasin assessment (SBA) portion of this document under the section *Analysis Process* (page 45). The water quality standards for the various pollutants can also be viewed in Appendix 3.

Sediment is impacting beneficial uses of McKinney Creek in the form of bedload sediment. Suspended sediment measured during drought years is not impacting water quality of the stream, however bedload sediment measured in the form of percent fines indicates that sediment is impacting water quality. A value greater than 35% for percent fines was used to indicate that sediment was impacting the water body. If this was the case then stream bank erosion inventories were completed to determine if stream bank erosion was the contributor of sediment impact. The target for stream bank erosion TMDLs is 80% bank stability.

Monitoring Points

As a stream bank erosion TMDL is site specific and can not be measured by a pour point value as some of the other constituents can there is no monitoring point to be measured for identification. One possible way of tracking changes within the system would be various Wohlman pebble counts in locations that have been used in the past. For the stream bank erosion TMDL the water body has been divided into six segments. These segments are as follows: upper, lower upper, upper middle, lower middle, upper lower, and lower lower.

Load Capacity

The load capacity estimates the quantity of pollutant the water body is believed to be able to assimilate and still maintain beneficial use full support status. Load capacity (72.4 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability.

Estimates of Existing Pollutant Loads

The estimated existing load for the sediment TMDL to be completed on McKinney Creek is elevated above the load capacity of the water body. The existing load (646.6 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability. This value represents the estimated existing loads of pollutant occurring in the water body.

Load Allocation

The wasteload allocation for McKinney Creek is limited to construction storm water wasteload allocations. The wasteload allocation for construction storm water was determined by allocating 2% of the load capacity to construction storm water. As this is the only point source in the watershed the allocation for sediment is 1.2 t/yr.

Background, MOS, and FG are values attributed to the watershed that are beyond human control, provide some flexibility within the watershed, and allow for future growth within the watershed. Calculations for each of these components were determined in various ways:

- Background loads are not determined for a stream bank erosion TMDL because it is implied that background loads occur within the target.
- The MOS for the sediment TMDLs for McKinney Creek is 10% of the load capacity (7.2 t/yr).
- The FG for the sediment TMDL for McKinney Creek is 5% of the load capacity (3.6 t/yr).

The final load allocations for nonpoint source activity are determined by reducing the load capacity of the water body by the wasteload allocations, background, MOS, and FG values. Therefore, the load allocation for sediment is 60.3 t/yr.

Table 95. McKinney Creek load reductions.

Pollutant	Critical flow (cfs)	Target	Load capacity	Existing Load	Percent reduction
sediment	2.5	80	72.4	646.6	88.8

[1]Sediment- target measured in percent bank stability, load capacity and existing load measured in t/yr.

Table 96. McKinney Creek load allocations.

Pollutant	MOS	BG	FG	Available Load	Wasteload allocation	Load Allocation
Sediment (t/yr)	7.2	Implicit	3.6	61.5	1.2	60.3

[a]Implicit- Background (BG) is implied within the target, Margin of safety (MOS) and Future growth (FG),

Table 97. McKinney Creek stream bank erosion values.

Reach	Existing Erosion rate	Proposed Erosion rate	Existing Total Erosion	Proposed Total Erosion	Erosion Rate Percent Reduction	Percent of Existing Total Load
Upper	45.0	6.8	126.1	19.0	85	19
Lower upper	25.0	7.7	24.5	7.5	69	4
Upper middle	62.0	14.7	83.8	19.8	76	13
Lower middle	7.3	5.0	7.9	5.4	32	1
Upper lower	82.4	2.7	171.3	5.5	97	26
Lower	96.3	6.2	233.1	15.1	94	36
Total			646.6	72.4		

[a]See Appendix 4 for site descriptions
[b]Erosion rates measured in tons/mile/year. Total erosion measured in tons/year.

Reasonable Assurance

There is reasonable assurance that implementation as the next step of the water body management process will occur. First this document includes implementation strategies that are in the subsequent pages. Idaho's water quality standards identify designated agencies that are responsible for evaluating and modifying best management practices to protect impaired water bodies. The state has committed itself to having implementation plans developed within 18 months of approval of the TMDL document. DEQ, the WAG, and the designated agencies will develop implementation plans, and DEQ will incorporate them into the states water quality management plan. Also in measuring the effectiveness of an implementation activity, DEQ will reassess the support status of the water body to determine if the water body has reached full support status. If full support status has not been obtained then further implementation will be necessary and further reassessment completed until full support status is completed. If full support status is completed then the requirements of the TMDL will be considered completed.

Dairy Creek

Through the subbasin assessment process, it has been identified that the water quality of Dairy Creek is being impacted by a pollutant as well as impacting the water quality of Mormon Reservoir. The pollutant of concern in the water body has been found to be sediment. Nutrients are a pollutant to Mormon Reservoir and as Dairy Creek is delivering an excessive load of nutrients to the reservoir a nutrient TMDL is being completed to restore water quality of the reservoir. For a summary of load reductions for this water body see Table 98, for load allocations see Table 99, and for segmental breakdown of stream bank erosion values see Table 100.

Design Conditions

Sediment impacts a water body during higher flow events, when the carrying capacity of the stream is greater and erosion is more likely to occur. Typically the higher flow events occur during spring runoff or periodically during storm situations; as a result the critical period for sediment on Dairy Creek has been identified as occurring from March to May. During this period the critical flow for the water body based on predicted hydrograph is 7.4 cfs. As sediment has been found to be occurring as a result of stream bank erosion the critical flow period is less important in the development of stream bank stability TMDLs.

Nutrients in a water body that is delivering to a storage system are more likely to impact a reservoir when the creek is supplying the reservoir with water as a reservoir acts as a sink and drops nutrients out of the water column. As a result the critical period for nutrients for Dairy Creek is from March to June, and the critical flow for this period based on the predicted hydrograph is 6.0 cfs. The average flow during the critical period aids in determining the loading capacity of the water body.

Target Selection

Target selections are discussed in more complete detail in the subbasin assessment (SBA) portion of this document under the section *Analysis Process* (page 45). The water quality standards for the various pollutants can also be viewed in Appendix 3.

Sediment is impacting the water quality of Dairy Creek in the form of bedload sediment. Suspended sediment measured during drought years is not impacting water quality of the stream, however bedload sediment measured in the form of percent fines indicates that sediment is impacting water quality. A value greater than 35% for percent fines was used to indicate that sediment was impacting the water body. If this was the case then stream bank erosion inventories were completed to determine if stream bank erosion was the contributor of sediment impact. The target for stream bank erosion TMDLs is 80% bank stability.

Nutrients are not impacting the water quality of Dairy Creek, but as the creek discharges into a reservoir a TMDL is completed to limit nutrient delivery. The target for water bodies discharging into a storage system is 0.050 mg/L. This goal should aid limiting excessive delivery of nutrients to the reservoir. As a result 0.050 mg/L is the target to be used in the development of a nutrient TMDL for Dairy Creek.

Monitoring Points

As a stream bank erosion TMDL is site specific and can not be measured by a pour point value as some of the other constituents can there is no monitoring point to be measured for identification. One possible way of tracking changes within the system would be various Wohlman pebble counts in locations that have been used in the past. For the stream bank erosion TMDL the water body has been divided into three segments. These segments are as follows: upper and lower.

The monitoring point for nutrient collection for TMDL development was located at the road crossing upstream of the reservoir. This site was located approximately a mile upstream of the reservoir. This site should be used to identify further trends or to assess the water body in the future.

Load Capacity

The load capacities of the two TMDLs to be completed on Dairy Creek have been determined in different ways.

- The load capacity (1.62 lbs/day) for nutrient TMDLs was calculated based on target selection and average critical flow.
- The load capacity (52.2 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability.

These values represent the estimated quantity of pollutant the water bodies are believed to be able to assimilate and still maintain beneficial uses full support status and meet water quality standards.

Estimates of Existing Pollutant Loads

The estimated existing loads for the two TMDLs to be completed on Dairy Creek are elevated above the load capacity of the water body:

- The existing load (2.7 lbs/day) for the nutrient TMDL was calculated based on average annual values of TP and the average critical flow.
- The existing load (1,677.2 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability.

These values represent the estimated existing load of pollutant occurring in the water body.

Load Allocation

The wasteload allocation for Dairy Creek is limited to construction storm water wasteload allocations. The wasteload allocation for construction storm water was determined by allocating 2% of the load capacity to construction storm water. As this is the only point source in the watershed the allocation for nutrients is 0.01 lbs/day and for sediment is 0.9 t/yr.

Background, MOS, and FG are values attributed to the watershed that are beyond human control, provide some flexibility within the watershed, and allow for future growth within the watershed. Calculations for each of these components were determined in various ways:

- Background for TP has been established as being 0.02 mg/L, which accounts for a load allocation of 0.65 lbs/day.
- Background loads are not determined for a stream bank erosion TMDL because it is implied that background loads occur within the target.

- The MOS for the TMDLs for Dairy Creek is 10% of the load capacity, for nutrients 0.16 lbs/day and for sediment 5.2 t/yr.
- The FG for the TMDLs for Dairy Creek is 5% of the load capacity, for nutrients 0.08 lbs/day and for sediment 2.6 t/yr.

The final load allocations for nonpoint source activity are determined by reducing the load capacity of the water body by the wasteload allocations, background, MOS, and FG values. Therefore, the load allocation for nutrients is 0.71 lbs/day and for sediment is 43.5 t/yr.

Table 98. Dairy Creek load reductions.

Pollutant	Critical flow (cfs)	Target	Load capacity	Existing Load	Percent reduction
sediment	7.4	80	52.2	1677.2	96.9
nutrient	6.0	0.050	1.62	2.75	41.2

[a]Sediment- target measured in percent bank stability, load capacity and existing load measured in t/yr.
[b]Nutrient- target measured in mg/L, load capacity and existing load measured in lbs/day.

Table 99. Dairy Creek load allocations.

Pollutant	MOS	BG	FG	Available Load	Wasteload allocation	Load Allocation
Sediment (t/yr)	5.2	Implicit	2.6	44.4	0.9	43.5
Nutrient (lbs/day)	0.16	0.65	0.08	0.73	0.01	0.71

[a]Implicit- Background (BG) is implied within the target.
[b]Margin of safety (MOS) and Future growth (FG), n.a.-not applicable.

Table 100. Dairy Creek stream erosion values.

Reach	Existing Erosion rate	Proposed Erosion rate	Existing Total Erosion	Proposed Total Erosion	Erosion Rate Percent Reduction	Percent of Existing Total Load
Upper	76.9	6.2	166.7	13.4	92	10
Lower	399.5	10.3	1,510.5	38.8	97	90
Total			1,677.2	52.2		

[a]See Appendix 4 for site descriptions
[b]Erosion rates measured in tons/mile/year. Total erosion measured in tons/year.

Reasonable Assurance

There is reasonable assurance that implementation as the next step of the water body management process will occur. First this document includes implementation strategies that are in the subsequent pages. Idaho's water quality standards identify designated agencies that are responsible for evaluating and modifying best management practices to protect impaired water bodies. The state has committed itself to having implementation plans developed within 18 months of approval of the TMDL document. DEQ, the WAG, and the designated agencies will develop implementation plans, and DEQ will incorporate them into the states water quality management plan. Also in measuring the effectiveness of an implementation activity, DEQ will reassess the support status of the water body to determine if the water body has reached full support status. If full support status has not been obtained then further implementation will be necessary and further reassessment completed until full support status is completed. If full support status is completed then the requirements of the TMDL will be considered completed.

Camas Creek

Through the subbasin assessment process, it has been identified that the water quality and beneficial uses of Camas Creek are being impacted by pollutants. The pollutants of concern in the water body have been found to be sediment, nutrients, and temperature. Nutrients are a pollutant to Camas Creek as well as to Magic Reservoir the receiving water of Camas Creek. For a summary of load reductions for this water body see Table 101, for load allocations see Table 102, and for segmental breakdown of stream bank erosion values see Table 103.

Lack of flow is the largest impact to beneficial uses of Camas Creek. Camas Creek is impaired due to a lack of flow; however, EPA does not believe that flow (or lack of flow) is a pollutant as defined by CWA Section 502(6). Since TMDLs are not required to be established for water bodies impaired by pollution, a TMDL has not been established for Camas Creek for flow.

Design Conditions

Sediment impacts a water body during higher flow events, when the carrying capacity of the stream is greater and erosion is more likely to occur. Typically the higher flow events occur during spring runoff or periodically during storm situations; as a result the critical period for sediment on Camas Creek has been identified as occurring from March to May. During this period the critical flow for the water body based on predicted hydrograph is 543.0 cfs. As sediment has been found to be occurring as a result of stream bank erosion the critical flow period is less important in the development of stream bank stability TMDLs.

Nutrients in a water body that is delivering to a storage system are more likely to impact a reservoir year round as the reservoir acts as a sink and drops nutrients out of solution. As a result the critical period for nutrients for Camas Creek is from March to October, and the critical flow for this period based on the predicted hydrograph is 228.4 cfs. The average flow during the critical period aids in determining the loading capacity of the water body.

Solar radiation impacts the temperature of a water body during the late spring and summer months, when canopy cover is the major component that maintains cooler water temperatures. As a result the critical period for temperature on Camas Creek has been identified as occurring from April to September. During this time, the critical flow for the water body, based on the predicted hydrograph, is 257.5 cfs. As a temperature TMDL targets canopy cover of a creek, the critical flow is less important in the development of a temperature TMDL.

Target Selection

Target selections are discussed in more complete detail in the subbasin assessment (SBA) portion of this document under the section *Analysis Process* (page 45). The water quality standards for the various pollutants can also be viewed in Appendix 3.

Sediment is impacting beneficial uses of Camas Creek in the form of bedload sediment. Suspended sediment measured during drought years is not impacting water quality of the stream, however bedload sediment measured in the form of percent fines indicates that sediment is impacting water quality. A value greater than 35% for percent fines was used to indicate that sediment was impacting the water body. If this was the case then stream bank erosion inventories were completed to determine if stream bank erosion was the contributor of sediment impact. The target for stream bank erosion TMDLs is 80% bank stability.

Nutrients are impacting the CWAL beneficial uses of Camas Creek, but as the creek discharges into a reservoir the TMDL is completed to limit nutrient delivery to the reservoir. The target for water bodies discharging into a storage system is 0.050 mg/L. This goal should aid limiting excessive delivery of nutrients to the reservoir. As a result 0.050 mg/L is the target to be used in the development of a nutrient TMDL for Camas Creek.

Temperature is impacting the water quality of Camas Creek and canopy cover is the method used to determine the amount of solar radiation the creek is receiving. Vegetation type and bankfull width were used to characterize the creek, then the Alvord Lake TMDL was used to aid in target selection based on these values (Table 66). The targets for the segments of the water body are as follows: upper (30%), lower upper (30%), upper middle (18%), lower middle (15%) and lower (15%). If the aerial photo estimates are less than the appropriate canopy cover target, canopy cover needs to be improved within the segment. Aerial photo estimations likely underestimate segments that have higher cover and overestimate segments that have lower cover, however in terms of the creek as a whole, these balance themselves out. This should be taken into account however during the implementation phase; the more critical areas are likely to be the areas with the least amount of canopy cover.

Monitoring Points

As a stream bank erosion TMDL is site specific and can not be measured by a pour point value as some of the other constituents can there is no monitoring point to be measured for identification. One possible way of tracking changes within the system would be various Wohlman pebble counts in locations that have been used in the past. For the stream bank erosion TMDL the water body has been divided into six segments. These segments are as follows: upper, lower upper, upper middle, lower middle, upper lower, and lower.

The monitoring point for nutrient collection for TMDL development was located in the lower portion of the watershed, at the Macon Flat bridge road crossing. This site was located approximately 4.5 miles upstream of the reservoir. This site should be used to identify further trends or to assess the water body in the future.

The monitoring point for temperature collection for TMDL development occurred at the USGS gauge station about 4 miles upstream of the mouth and in the spring complex of the creek about 4 miles downstream of the headwaters. Both sites can be used to identify further trends within the system; however the lower site upstream of the mouth should be used to determine if water quality standards on Camas Creek are being met.

Load Capacity

The load capacities of the three TMDLs to be completed on Camas Creek have been determined in different ways.

- The load capacity (61.55 lbs/day) for nutrient TMDLs was calculated based on target selection and average critical flow.
- The load capacity (512.6 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability.
- The load capacity (4,506,297.5 kWh/day) for the temperature TMDL was determined by converting canopy cover targets to solar radiation.

These values represent the estimated quantity of pollutant the water bodies are believed to be able to assimilate and still maintain beneficial uses full support status and meet water quality standards.

Estimates of Existing Pollutant Loads

The estimated existing loads for the three TMDLs to be completed on Camas Creek are elevated above the load capacity of the water body:

- The existing load (130.49 lbs/day) for nutrient TMDLs was calculated based on average annual values of TP and the average critical flow.
- The existing load (8,018.8 t/yr) for stream bank erosion TMDLs was set at calculations that took into account erosion rates, bank height, and quantity of stream bank stability.
- The existing load (4,969,018.0 kWh/day) for temperature TMDLs was calculated as the sum of the amount of solar radiation for the segments of the creek.

These values represent the estimated existing load of pollutant occurring in the water body.

Load Allocation

The wasteload allocation for Camas Creek is limited to construction storm water wasteload allocations. The wasteload allocation for construction storm water was determined by allocating 2% of the load capacity to construction storm water. As this is the only point source in the watershed the allocation for nutrients is 0.55 lbs/day and for sediment is 8.7 t/yr. Wasteload allocations are not made for construction storm water for a temperature TMDL based on canopy cover.

Background, MOS, and FG are values attributed to the watershed that are beyond human control, provide some flexibility within the watershed, and allow for future growth within the watershed. Calculations for each of these components were determined in various ways:

- The BG for TP has been established as being 0.02 mg/L, which accounts for a load allocation of 24.62 lbs/day.
- The BG is not determined for a stream bank erosion TMDL because it is implied that background loads occur within the target.
- The BG, MOS, and FG are not determined for a temperature TMDL because the canopy cover targets are set for natural potential vegetation.
- The MOS for the TMDLs for Camas Creek is 10% of the load capacity, for nutrients 6.16 lbs/day and for sediment 51.3 t/yr.
- The FG for the TMDLs for Camas Creek is 5% of the load capacity, for nutrients 3.08 lbs/day and for sediment 25.6 t/yr.

The final load allocations for nonpoint source activity are determined by reducing the load capacity of the water body by the wasteload allocations, background, MOS, and FG values. Therefore, the load allocation for nutrients is 27.15 lbs/day, for sediment is 427.0 t/yr, and for temperature is 4,506,297.5 kWh/day.

Table 101. Camas Creek load reductions.

Pollutant	Critical flow (cfs)	Target	Load capacity	Existing Load	Percent reduction
sediment	543.0	80	512.6	8,018.8	93.6
nutrient	228.4	0.050	61.55	130.49	52.8
temperature	257.5	30-30-18-15-15	4,506,297.5	4,969,018.0	9.3

[a]Sediment- target measured in percent bank stability, load capacity and existing load measured in t/yr.
[b]Nutrient- target measured in mg/L, load capacity and existing load measured in lbs/day.
[c]Temperature – target measured in percent canopy cover, load capacity and existing load measured in kWh/day.

Table 102. Camas Creek load allocations.

Pollutant	MOS	BG	FG	Available Load	Wasteload allocation	Load Allocation
Sediment (t/yr)	51.3	implicit	25.6	435.7	8.7	427.0
Nutrient (lbs/day)	6.16	24.62	3.08	27.70	0.55	27.15
Temperature (kWh/day)	n.a.	n.a.	n.a.	4,506,297.5	0.0	4,506,297.5

[a]Implicit- Background (BG) is implied within the target.
[b]Margin of safety (MOS) and Future growth (FG), n.a.-not applicable.

Table 103. Camas Creek stream erosion values.

Reach	Existing Erosion rate	Proposed Erosion rate	Existing Total Erosion	Proposed Total Erosion	Erosion Rate Percent Reduction	Percent of Existing Total Load
Upper	6.2	3.5	29.3	16.8	43	0.4
Lower upper	28.2	11.3	267.7	107.3	60	3.3
Upper middle	2.4	1.7	19.0	13.1	31	0.2
Lower middle	5.4	4.1	68.6	13.1	24	0.9
Upper lower	535.9	23.5	7,566.6	331.5	96	94.4
Lower	9.6	4.4	67.6	30.9	54	0.8
Total			8,018.8	512.6		

[a]See Appendix 4 for site descriptions
[b]Erosion rates measured in tons/mile/year. Total erosion measured in tons/year

Reasonable Assurance

There is reasonable assurance that implementation as the next step of the water body management process will occur. First this document includes implementation strategies that are in the subsequent pages. Idaho's water quality standards identify designated agencies that are responsible for evaluating and modifying best management practices to protect impaired water bodies. The state has committed itself to having implementation plans developed within 18 months of approval of the TMDL document. DEQ, the WAG, and the designated agencies will develop implementation plans, and DEQ will incorporate them into the states water quality management plan. Also in measuring the effectiveness of an implementation activity, DEQ will reassess the support status of the water body to determine if the water body has reached full support status. If full support status has not been obtained then further implementation will be necessary and further reassessment completed until full support status is completed. If full support status is completed then the requirements of the TMDL will be considered completed.

Construction Storm Water and TMDL Wasteload Allocations

Construction Storm Water

The Clean Water Act requires operators of construction sites to obtain permit coverage to discharge storm water to a water body or to a municipal storm sewer. In Idaho, EPA has issued a general permit for storm water discharges from construction sites. In the past storm water was treated as a non-point source of pollutants. However, because storm water can be managed on site through management practices or when discharged through a discrete conveyance such as a storm sewer, it now requires a National Pollution Discharge Elimination System (NPDES) Permit.

The Construction General Permit (CGP)

If a construction project disturbs more than one acre of land (or is part of larger common development) that will disturb more than one acre), the operator is required to apply for permit coverage from EPA after developing a site-specific Storm Water Pollution Prevention Plan.

Storm Water Pollution Prevention Plan (SWPPP)

In order to obtain the Construction General Permit operators must develop a site-specific Storm Water Pollution Prevention Plan. The operator must document the erosion, sediment, and pollution controls they intend to use, inspect the controls periodically and maintain the *best management practices* (BMPs) through the life of the project.

Construction Storm Water Requirements

When a stream is on Idaho's § 303(d) list and has a TMDL developed DEQ now incorporates a gross wasteload allocation (WLA) for anticipated construction storm water activities. TMDLs developed in the past that did not have a WLA for construction storm water activities will also be considered in compliance with provisions of the TMDL if they obtain a CGP under the NPDES program and implement the appropriate Best Management Practices. Typically there are specific requirements you must follow to be consistent with any local pollutant allocations. Many communities throughout Idaho are currently developing rules for post-construction storm water management. Sediment is usually the main pollutant of concern in storm water from construction sites. The application of specific best management practices from *Idaho's Catalog of Storm Water Best Management Practices for Idaho Cities and Counties* is generally sufficient to meet the standards and requirements of the General Construction Permit, unless local ordinances have more stringent and site specific standards that are applicable.

Future Growth Potential

Nonpoint source future growth potential such as subdivision development or similar ventures within the stream corridors must provide sufficient protection of nutrient (TP and nitrogen), sediment (TSS and stream bank stability), temperature (canopy cover), and bacteria pollutants so that TMDL targets and goals are maintained. Subdivisions, although defined as a nonpoint source, have the tendency with septic systems to produce more TP than what would be allocated to straight agricultural lands. This assumes that the septic discharge enters the associated water body. Consequently, the TP loading limit for subsurface sewage disposal (IDAPA 58.01.03) or wastewater land application (IDAPA 58.01.17) is contained in the

TMDL as part of the nonpoint source load allocation. Point source wasteload allocations are enforceable under NPDES permits and IDAPA 58.01.02.400. Moreover, nonpoint source load allocations are enforceable under the Idaho Administrative Procedures Act (IDAPA 58.01.02.250). In addition, DEQ policy relative to subdivision development within stream corridors should be reviewed in consultation with local planning and zoning restrictions for appropriate consideration.

5.2 Implementation Strategies

The implementation strategy of the Camas Creek Subbasin is written to provide a brief outline of the implementation plan to be completed 18 months after EPA approval of this document. This strategy will also provide reasonable assurance that Best Management Practices (BMPs) will be implemented to help bring back beneficial use support status. DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that the TMDL goals are not being met or significant progress is not being made toward achieving the goals. The implementation strategy is discussed further in Appendix 6.

5.3 Conclusions

This section of the document will summarize available data and assessment outcomes for each of the water bodies.

The following table (Table 104) describes the available data and whether or not assessment criteria were met in the water bodies.

Table 104. Summary of assessment criteria results.

Data type	Soldier Creek	Willow Creek	Beaver Creek	Little Beaver Creek	Camp Creek	Elk Creek	Corral Creek	Wild Horse Creek	Camas Creek	McKinney Creek	Dairy Creek
Hydrology	P/I	P	P	P	P/I	P/I	P/I	I/P	P/I	P/I	I
Flow alteration	IBU	NIBU	NIBU	NIBU	IBU	IBU	IBU	IBU	IBU	IBU	IBU
Biological data (BURP)	NA	MBU	MBU	MBU	NA	NA	NA	NA	NA	NMBU	NA
DO, pH, turbidity	M	M	M	DG	M	M	M	M	M	M	M
TSS	M	M	M	M	M	M	M	M	M	M	M
% fines	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Bank Erosion	NM	NM	M	DG	NM	NM	NM	NM	NM	NM	NM
Nutrients	M	M	M	DG	M	M	M	M	NM	NM	NM
Bacteria	M	M	M	DG	M	M	M	NM	M	M	M
Temperature	NM	NM	NM	NM	NM	DG	NM	NM	NM	DG	DG
Canopy Cover	NM	NM	NM	NM	NM	NA	NM	NM	NM	NA	NA

[a] Abbreviations: P-perennial water body, I-intermittent water body, NIBU-not impacting beneficial uses, IBU-impacting beneficial uses, MBU-meeting beneficial uses, NA-not assessed, DG-data gap, M-meeting standards or assessment criteria, NM-not meeting standards or assessment criteria.

The following table (Table 105) describes the assessment outcomes made for the Camas Creek Subbasin through the SBA and TMDL process. Table 106 identifies the water bodies impacted by flow alteration.

Table 105. Summary of assessment outcomes.

Water body	Assessment Unit	Pollutant	TMDL Done	Recommended Changes to §303(d) List	Justification
Camas Creek	ID17040220SK013_05 ID17040220SK001_05 ID17040220SK007_05 ID17040220SK018_04 ID17040220SK018_03 ID17040220SK018_02	SED, TEMP, NUT	Yes	Add TEMP, NUT, and QALT,	Not meeting standards, delivery to storage system, channelization and diversion
Soldier Creek	ID17040220SK011_02	SED, TEMP	Yes	Remove DO, BACT, NUT Add TEMP	Meeting standards or criteria, Not meeting standards
Mormon Reservoir	ID17040220SK023L_0L	SED, TEMP	Yes	Remove BAC	Meeting standards
Little Beaver Creek	ID17040220SK004_02	TEMP	Yes	Add TEMP	Not meeting standards
Camp Creek	ID17040220SK002_02 ID17040220SK002_03	SED, TEMP	Yes	Remove UNK, Add SED, TEMP, QALT	Not meeting standards or criteria, channelization and storage
Willow Creek	ID17040220SK003_04	TEMP	Yes	Remove UNK, Add TEMP	Not meeting standards
Elk Creek	ID17040220SK006_02	SED	Yes	Remove UNK, Add SED	Not meeting criteria
McKinney Creek	ID17040220SK025_02	SED	Yes	Remove UNK, Add SED	Not meeting criteria
Corral Creek	ID17040220SK015_03	SED, TEMP	Yes	Remove UNK, Add SED, TEMP	Not meeting criteria or standards
Cow Creek	ID17040220SK018_02	SED, NUT	Yes	Remove UNK, Add SED, NUT	Delivering to storage system, not meeting criteria
Wild Horse Creek	ID17040220SK021_03	SED, BACT, TEMP	Yes	Remove UNK, Add SED, BACT, TEMP	Not meeting criteria or standards
Beaver Creek	ID17040220SK004_02	TEMP	Yes	Remove UNK, Add TEMP	Not meeting standards
Dairy Creek	ID17040220SK024_02	SED, NUT	Yes	Add SED, NUT	Delivering to storage system, not meeting criteria

[a]1998 303(d) refers to a list created in 1998 of water bodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection “d” of the Clean Water Act.
[b]AU- assessment unit (assessment unit prefix to values in table is Id17040221), SED- sediment, NUT- nutrient, BAC- bacteria, TEMP- temperature, DO- dissolved oxygen, QALT- flow alteration, UNK-Unknown.
[c]303(d) listed segments will remain the same; however TMDLs will be completed on the entire stretch of the creek.

Table 106. Flow alteration impacting water quality.

Water body Segment	Assessment Unit	Flow Alteration Impacting Water Quality
Camas Creek	ID17040220SK013_05	Yes
Camas Creek	ID17040220SK001_05	Yes
Camas Creek	ID17040220SK007_05	Yes
Camas Creek	ID17040220SK018_04	Yes
Camas Creek	ID17040220SK018_03	Yes
Camas Creek	ID17040220SK018_02	Yes
Soldier Creek	ID17040220SK011_02	Yes
Mormon Reservoir	ID17040220SK023L_0L	Yes
Little Beaver Creek	ID17040220SK004_02	No
Camp Creek	ID17040220SK002_02	Yes
Camp Creek	ID17040220SK002_03	Yes
Willow Creek	ID17040220SK003_04	No
Elk Creek	ID17040220SK006_02	Yes
McKinney Creek	ID17040220SK025_02	Yes
Corral Creek	ID17040220SK015_03	Yes
Cow Creek	ID17040220SK018_02	No
Wild Horse Creek	ID17040220SK021_03	Yes
Beaver Creek	ID17040220SK004_02	No
Dairy Creek	ID17040220SK024_02	Yes